Discussion

Dr J. Luketich ***(Pittsburgh, Pa).*** Dr Wright, that was an excellent presentation, and I congratulate you and your colleagues on your efforts to utilize the STS database, which includes close to 2000 cases of esophagectomy, to create a model of perioperative risk. One very important finding of your study, as you point out, is that thoracic surgeons participating in the STS database have a markedly lower mortality rate of only 2.5% compared with the Medicare database showing alarming mortality rates between 8% and 23%. I have several questions about your study.

What is the quality control of the data collection of the STS database? Are charts periodically audited by the STS during site visits? Along these lines, has your statistician voiced concerns about including the pulmonary function data, with fewer than 40% of patients having reported spirometry yet the finding of an overall correlation with outcome? And I wonder if you could comment specifically on which morbidities that the lower FEV_1 was associated with. And has this influenced your practice? If you encounter a patient with an $FEV_1 < 60\%$, are you excluding them from esophagectomy?

Dr Wright ***(Boston, Mass).*** Thank you for that question. Currently, the STS does not audit the data in their database. This is a new database, in existence for only 6 years. You have to remember that the cardiac database, in existence for over 15 years, has only been audited since 3 years ago, I believe. Their initial audit, I think, was recognized as a success, indicating a less than 10% variation in data elements. We anticipate the same results, but we have not started that yet. It is clearly something we need to do.

We specifically excluded the use of pulmonary function tests in our multivariate model because only 40% of our patients had pulmonary function tests performed. Thus we only did a univariate analysis of pulmonary function tests. I think that was an honest way to treat that as we had so much missing data. Certainly, we encourage surgeons to enter these data, because this is clearly going to be an important risk factor.

Dr J. Luketich. Thank you. Second question. How serious was the missing data problem with other variables? And I think you have answered the other questions about the auditing plans. But was the rate of missing variables of key comorbidity and outcome variables of concern?

Dr Wright. Well, missing variables are always of concern to the people looking at the database, but I think they were within reason. For race, age, and gender, there were no missing variables. BMI was 13%; cigarette smoking, 13%; diabetes, 5%; peripheral vascular disease, 13%. The rate of missing variables for outcome measures was <3%.

Dr. Luketich. My final question is in regards to the lack of a volume/outcome relationship for the number of esophagectomies performed annually in each center. Your analysis included 40 of the 68 sites, and as I understand it, 28 sites performing fewer than 5 esophagectomies per year were excluded from the analysis. I wonder if the results would be similar if all sites were included? It would seem like the hospitals with the very lowest numbers of esophagectomies annually are the very hospitals we want to examine when it comes to low volume of index cases and high complication and death rates. Did you analyze and correct for other factors such as surgeon volume and specialty training? And do you think that the requirement for thoracic board certification and performance of esophagectomies in academic medical centers influence your findings?

Dr Wright. That is an excellent question, a 2-part question. In answer to the first part, our statisticians thought it was not statistically valid to include sites that had fewer than 1 esophagectomy per year, because they were looking on a per-year basis. It would be interesting to go back and see what those results were. But certainly the sites to the right on my graph show 1 case a year versus 60 cases a year. There is not a lot of difference.

Certainly I don't propose that this volume/performance relationship is true of all of America. The STS thoracic database participants are very select. They belong to the STS, they are board certified, and they are very interested in quality improvement, and I think that is why the results are so good.

Dr S. DeMeester ***(Los Angeles, Calif).*** Cam, thank you very much for that interesting presentation and data. Just a quick question. Did you analyze induction therapy as either yes or no, they had it or didn't have it, or did you stratify by the amount of radiation? As you know, it has been demonstrated that high radiation doses seem to be associated with the risk of increased morbidity or mortality.

Dr Wright. That is another good question, and we currently in our data field only collect radiation as yes or no. So we could not do that stratification.

Dr J. Benfield ***(Los Angeles, Calif).*** Many esophagectomies are done by general surgeons. Do you see any way to gather meaningful data to compare outcomes of general surgeons with those of thoracic surgeons?

Dr Wright. Well, I believe that paper has already been written by Mark Orringer's group at the University of Michigan, and they did show that there was a modest improvement in results if you were a board-certified thoracic surgeon as opposed to a general surgeon.

Dr T. Karamlou ***(Portland, Ore).*** Two quick questions. One, what was the conduct of the esophagectomies? Were these transhiatal, transthoracic, Ivor-Lewis, laparoscopic, 3 fields? And number 2, how is the diagnosis of some of the comorbidities arrived at, specifically pneumonia? Was this just a yes/no, or were there strict criteria for establishing this as you used it as one of your composite end points?

Dr. Wright. Pneumonia is defined in the database. It is a standard definition of a white count, fever, and a change in sputum. All the definitions are standardized. We did collect what type of esophagectomy was done, and transhiatal was by far and away the commonest esophagectomy performed. But all varieties were looked at, including Ivor-Lewis and the 3-hole type. We did not stratify outcome according to esophagectomy type.

Dr N. Altorki ***(New York, NY).*** Cam, I enjoyed your presentation. I was wondering why you did not include in the measure of morbidity electrical instability, atrial arrhythmias, and this sort. In our experience, it has been the cause of major morbidity and prolongation of the hospital stay, and why was that not entered in your model?

Dr. Wright. That was a clinical judgment decision in terms of how major is major. We are aware that atrial fibrillation is a marker for other bad things happening. Most serious events are respiratory events, and so we were really focused on pulmonary complications and morbidity and death after esophagectomy. But I take your point that it is a judgment call.